



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/270,039	03/16/1999	JUDY H HUANG	AMAT/3434/PD	1949
32588	7590	03/05/2004	EXAMINER	
APPLIED MATERIALS, INC. 2881 SCOTT BLVD. M/S 2061 SANTA CLARA, CA 95050			FOURSON III, GEORGE R	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 03/05/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/270,039

Applicant(s)

HUANG, JUDY H

Examiner

George Fourson

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 14-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 14-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 14-28,30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Endo et al '150, Europe '440, Loboda et al, newly cited, Somekh and Zhao.

Endo discloses formation of SiC W plasma deposition at 50-500°C on silicon using methylsilane as source gas and helium carrier gas at 0.05-10 Torr exemplifying use of 100 W Rf power to create the plasma. The reference does not disclose depositing a layer over the SiC layer or the dielectric constant of the SiC layer produced.

Europe '440 discloses plasma deposition of a SiC barrier layer using methylsilane as source gas at 0.1-5 W/cm², 50-600°C on a dielectric layer followed by formation of a metal layer on the SiC layer. The reference also discloses that the layers 5 and 9 can be SiC (col.4). One of ordinary skill in the art would have been led to the recited conditions and therefore the recited dielectric constant of the SiC layer produced through routine optimization of the formation conditions within the teachings of the reference. The choice of particular thicknesses of layers used would have depended on the desired device dimensions and device characteristics on the finished wafer and therefore would have been a matter of routine optimization. Further, it would have been an obvious matter of design choice bounded by well known manufacturing constraints and ascertainable by routine experimentation and optimization to choose these particular dimensions because applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious

Art Unit: 2823

purpose, produce an unexpected result, or are otherwise critical. See, for example, *In re Rose*, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); *In re Rinehart*, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); *Gardner v. TEC Systems, Inc.*, 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See also MPEP 2144.04(IV)(B).

Applicant admits the formation of SiC as an antireflective layer to have been known prior to Applicant's invention.

The combination of Endo et al '150 and Europe '440 does not include formation of a SiC barrier layer, a Si-O-C dielectric layer formed in-situ on the SiC barrier layer, a SiC etch stop on dielectric layer, a second dielectric layer on the etch stop, etching the first and second dielectric layers to form a damascene structure, forming a liner layer in the damascene structure, forming a conductive material layer and depositing a SiC barrier layer on the Cu layer.

Applicant admits in U.S. Application S.N. 99/165,242, figure 1, the process of forming a barrier layer 13, a dielectric layer 14 on the barrier layer, an etch stop 16 on the dielectric layer, a second dielectric layer 18 on the etch stop, etching the first and second dielectric layers, forming a TaN liner layer 22, forming a Cu conductive material layer 20 and depositing a barrier layer on the Cu layer to have been known prior to applicant's invention.

Europe '440 discloses that the SiC produced by the process therein is useful as useful as barrier layer 4, interlayer dielectric layers 5 and 9 and barrier layer 2. Loboda discloses that in-situ SiC/SiOC/SiC films produced using methylsilane as source gas are useful as intermetal dielectrics (col.4, lines 5-20). Somekh discloses forming SiC, low k etch stop 14 between dielectric layers (col.5, lines 33-41). Zhao discloses forming SiC etch stop 312 between dielectric layers (c01.5, lines 55-61).

Art Unit: 2823

In view of the disclosures of Europe'440, Loboda et al, Somekh and Zhao that SiC and in-situ Si-O-C formed on SiC is useful as a dielectric layer, barrier layer and etch stop, it would have been within the scope of one of ordinary skill in the art to combine the teachings of Endo et al '150, Europe '440 and Loboda et al with those of either one of Somekh and Zhao to enable formation of the structure of prior art figure 1 discussed above.

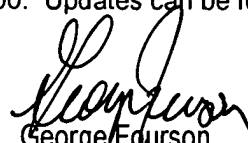
Claim 29 is rejected Claims 14-28,30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Endo et al '150, Europe '440, Loboda et al, newly cited, Somekh and Zhao as applied to claims 14-28,30 and 31 above and further in view of Subrahmanyam et al.

The combination does not include nitrogen/hydrogen plasma cleaning. Subrahmanyam et al discloses nitrogen/hydrogen plasma cleaning of metallization exposed by a via to remove oxides by reduction thereby decreasing contact resistance (col.7, lines 43-54). It would have been within the scope of one of ordinary skill in the art to combine the teachings of the combination and Subrahmanyam et al to achieve reduction of contact resistance.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group Receptionist whose telephone number is (703) 308-0956 until 2/4/04. See MPEP 203.08.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner George Fourson whose telephone number is (571)272-1860. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (571)272-1855. The fax number for this group is (571)273-0224 and the customer service number for group 2800 is 571-272-2800. Updates can be found at <http://www.uspto.gov/web/info/2800.htm>.


George Fourson
Primary Examiner
Art Unit 2823